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(54) **NEGOTIATION OF QUALITY OF SERVICE (QOS) INFORMATION FOR NETWORK MANAGEMENT TRAFFIC IN A WIRELESS LOCAL AREA NETWORK (WLAN)**

VERHANDLUNG VON QOS-INFORMATIONEN FÜR NETZVERWALTUNGSVERKEHR IN EINEM WLAN

NÉGOCIATION D'INFORMATIONS DE QUALITÉ DE SERVICE (QOS) POUR UN TRAFIC DE GESTION DE RÉSEAU DANS UN RÉSEAU LOCAL SANS FIL (WLAN)

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- **"IEEE Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 8: Medium Access Control (MAC) Qua", IEEE STANDARD; [IEEE STANDARD], IEEE, PISCATAWAY, NJ, USA, 1 January 2005 (2005-01-01), pages _1-189, XP017603828, ISBN: 978-0-7381-4772-7**

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Description

TECHNICAL FIELD

[0001] The technology described herein generally relates to wireless local area networks (WLANs), and more particularly, to the handling of network management traffic in a WLAN.

BACKGROUND

[0002] The enhanced Distributed Channel Access (EDCA) of the Institute of Electrical and Electronics Engineers (IEEE) standard 802.11 is an enhancement to the original IEEE 802.11 Media Access Control (MAC) sublayer and is a method of medium access described in the standard amendment document IEEE 802.11e. EDCA provides four prioritized queues for transmission, where each queue is associated with a different access category (AC). The four access categories defined, for example, in IEEE standard 802.1 le, in decreasing priority, are AC_VO, AC_VI, AC_BE and AC_BK, named for voice traffic, video traffic, best-effort traffic, and background traffic, respectively. The queues use a contention-based mechanism to determine the next frame for transmission. The queue parameters are set such that the high priority queues have a preference for access to the wireless medium

[0003] Management frames are the foundation of network management traffic in a Wireless Local Area Network (WLAN). Current IEEE 802.11 standards dictate that, in any access point (AP) or non-AP station (STA), management frames are to be handled via the EDCA queue of highest priority.

[0004] Michael Montemurro: "TGae Requirements and Use Cases"; IEEE P802.11 Wireless LANs; IEEE 802.11-10/0093r5 describes the use cases and requirements for prioritisation of management frames and describes a number of issues associated therewith.

[0005] "IEEE Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 8: Medium Access Control (MAC) Quality of Service Enhancements"; IEEE Standard describes the MAC procedures to support local area network (LAN) applications with quality of service (QoS) requirements, which include the transport of voice, audio, and video over IEEE 802.11 wireless LANs (WLANs).

[0006] EP 1 919 154 A1 describes the transmission of signaling frames in a QoS system which may be prioritized over the transmission of content frames carrying time-sensitive information. The signaling frames and the content frames may belong to a single communication session or may belong to a different communication session than the content frames and the signaling frames and the content frames may be audio frames, video frames or frames of other time-sensitive information.

[0007] Aspects of the invention are defined in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is an illustration of an example network architecture for advertisement of management frame QoS (MFQ) information within a basic service set (BSS);

FIG. 2 is an illustration of an example method to be implemented by an access point (AP) for advertisement of MFQ information;

FIG. 3 is an illustration of an example method to be implemented by an AP for including MFQ information in a downlink frame;

FIG. 4 is an illustration of an example method to be implemented by a station (STA) associated with an AP for handling MFQ information received from the AP in a downlink frame;

FIG. 5 is an illustration of example formatting information for a MFQ element;

FIG. 6 is an illustration of an example method to be performed by a STA associated with an AP for requesting permission from the AP to deviate from MFQ information currently advertised by the AP, receiving a policy configuration response from the AP, and acting on the received policy configuration response;

FIG. 7 is an illustration of an example method to be performed by an AP for receiving a policy configuration request from an associated STA for permission to deviate from MFQ information currently advertised by the AP and for responding to the policy configuration request;

FIG. 8 is an illustration of example formatting for a policy configuration request;

FIG. 9 is an illustration of example formatting for a policy configuration response;

FIG. 10 is an illustration of example formatting for a policy stop message;

FIG. 11 is a block diagram of an example AP;

FIG. 12 is a block diagram of an example STA;

FIG. 13 is a block diagram of a media access control (MAC) sublayer module of an AP; and

FIG. 14 is a block diagram of a MAC sublayer module of a STA.

DETAILED DESCRIPTION

[0009] The disclosure can be better understood with reference to the following drawings and description. The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the disclosed technology. Moreover, in the figures, like referenced numerals designate corresponding parts or elements throughout the different views. The following description is merely exemplary in nature and is in no way intended to limit the disclosure, its application, or uses. As used herein, the term "module" refers to an Application Specific Integrated Circuit (ASIC), an electronic circuit, a processor (shared, dedicated, or group) and memory that executes one or more software or firmware programs stored in the memory, a combinational logical circuit, and/or other suitable components that provide the described functionality. Herein, the phrase "coupled with" is defined to mean directly connected to or indirectly connected through one or more intermediate components. Such intermediate components may include both hardware and software based components.

[0010] Recent amendments to the IEEE 802.11 family of standards have increased the number and type of management frames, resulting in an increase in network management traffic. If all management frames continue to be handled as frames of the highest priority, this may adversely affect overall network performance or the ability to provide Quality of Service (QoS) to data frames or both. For example, it would not be desirable for the transmission of diagnostic reports to reduce the quality of a voice call.

[0011] By way of introduction, the disclosure is related to the prioritization of management frames and are merely exemplary in nature. More particularly, the present disclosure describes the implementation of prioritization scheme(s) that define various access categories of different management frames, where each of the access categories is associated with a respective prioritization used for transmission. An access category may be defined for a group of management frame subtypes or for an individual management frame subtype.

[0012] In the present disclosure, access categories AC_BK, AC_BE, AC_VI and AC_VO named for background traffic, best-effort traffic, video traffic, and voice traffic, respectively, are used to illustrate the concepts described herein. However, it is contemplated that the list of access categories may be different. If the list of access categories is different, then the number or definition or both of access-category-dependent queues in a compatible media access control (MAC) sublayer will also be different. An access category is a label given to a common set of enhanced distributed channel access (EDCA) parameters that are used, for example, by a station to contend for a channel in order to transmit information with certain priorities. In other words, each respective access category (e.g., AC_BK, AC_BE, AC_VI and AC_VO) is associated with (i.e., characterized by or indicative of) a respective priority used for transmission by a station.

[0013] Each data frame generated by an application in a non-access point (non-AP) station (STA) already has an indication of its priority. As used herein, the term "data frame" includes both a content data frame and a signaling data frame. For example, any one or any combination of the following values is an example indication of the priority of a data frame: a user priority assigned to the data frame; the IP-ToS (Internet Protocol - Type of Service) value in an IP header of the data frame; and a Differentiated Services Code Point (DSCP) value in the IP header of the data frame. The classification of a data frame to an access category by a MAC sublayer module of a non-AP STA may be based upon the data frame's indication of priority. For example, data frames having various user priorities may be classified as follows:

User Priority	Access Category
001	AC_BK
010	AC_BK
000	AC_BE
011	AC_BE
100	AC_VI
101	AC_VI
110	AC_VO
111	AC_VO

[0014] Conventionally, management frames, in contrast to data frames, do not have an indication of priority, so there is no inherent classification of a management frame to an access category. Management frames are generated within the MAC sublayer module of an AP and/or a STA.

[0015] As proposed in the present disclosure, the prioritization scheme includes a default management frame QoS (MFQ) policy, which is a static definition of access categories for management frames. The default MFQ policy is implementable by a MAC sublayer module of an AP or non-AP STA. The default MFQ policy is known to all APs and STAs and is therefore not advertised. An example default MFQ policy includes the following definitions, where the access category of management frames not included in the following table is AC_BE:

Management Frame Subtypes	Access Category
Beacon (Re)Association Request/Response Probe Request (individually addressed) Probe Response Announcement Traffic Indication Message (ATIM) Dissassociation Authentication Deauthentication Spectrum management - channel switch announcement QoS Block Ack Public - extended channel switch announcement Public - measurement pilot Public - TDLS Discovery Response Fast BSS Transition HT SA Query Protected Dual of Public Action - extended channel switch announcement	AC_VO
Mesh Action - HWMP Mesh Path Selection Self Protected	AC_VI
Spectrum Management Public Protected Dual of Public Action WNM Unprotected WNM Mesh Action Multihop Action Vendor-specific Protected	AC_BE

(continued)

Management Frame Subtypes	Access Category
Vendor-specific	

[0016] As proposed in the present disclosure, a MFQ policy will apply to a basic service set (BSS), which comprises an AP and any non-AP STAs associated with the AP. Therefore, the MFQ policy in effect in one BSS may differ from the MFQ policy in effect in a different BSS. In particular, the MFQ policy in effect in a BSS may differ from the default MFQ policy. The MFQ policies in effect in different BSSs belonging to the same extended service set (ESS) may be identical to one another, but this is not necessary. The MFQ policy in effect in a BSS may change over time. The prioritization scheme for management frames of the present disclosure is therefore dynamic in that the prioritization scheme allows for changes over time in the definition of access categories for management frame subtypes.

[0017] Furthermore, as proposed herein, the AP of the BSS will determine the MFQ policy that is currently in effect in the BSS and transmit management frames according that policy. The AP advertises MFQ information that describes how the MFQ policy currently in effect in the BSS differs from the default MFQ policy. Therefore, the MFQ policy currently in effect in a BSS may be referred to as the advertised MFQ policy, even though only the differences between the MFQ policy currently in effect in the BSS and the default MFQ policy are advertised. An associated STA is therefore informed of the MFQ policy currently in effect in the BSS through receipt of the advertised MFQ information.

[0018] In accordance with the present disclosure, an associated STA may follow the MFQ policy determined by the AP with which the STA is associated. Alternatively, an associated STA may follow the MFQ policy determined by the AP with which the STA is associated unless the STA has successfully negotiated a different MFQ policy with the AP. Compliance of an associated STA to the advertised MFQ policy or to the negotiated MFQ policy is not actually checked by the AP with which the STA is associated, because prioritization of management frames is handled internally in the STA prior to transmission of the frames.

Advertisement of MFQ Policy by AP

[0019] FIG. 1 is an illustration of an example network architecture for advertisement of MFQ information by an AP of a wireless local area network (WLAN). The WLAN may be configured using IEEE 802.11 technology, and/or or other wireless communication standards including other WLAN standards, personal area network (PAN) standards, wide area network (WAN) standards, or cellular communication standards or networks for providing wireless network communications.

[0020] In the network architecture shown in FIG. 1, a WLAN access point (AP) 10 is coupled to a network 12, possibly through a wired communication interface, a satellite interface, a Worldwide Interoperability for Microwave Access (WiMAX®) communication interface, or any other suitable communication interface. AP 10 broadcasts beacon frames. Stations 14 are WLAN devices that are within range (i.e., within communication range) of AP 10 and are associated with AP 10. AP 10 and stations 14 together form a basic service set (BSS) 16. A basic service set identifier (BSSID) identifies BSS 16, and is included in every management frame sent by AP 10 or STAs 14. The MAC address of AP 10 is often used as the BSSID. The network to which BSS 16 belongs is identified by its network name, referred to as a service set identifier (SSID). Unless hidden, the SSID is included in certain downlink frames, including, for example, beacon frames and probe response frames transmitted by AP 10.

[0021] A station (STA) 18 is within range of AP 10 but is not associated with AP 10. STA 18 is therefore not part of the BSS. STA 18 may detect the existence of AP 10 by undergoing a network discovery process to identify the available wireless local area networks within range. In some implementations, the network discovery process includes the receipt by STA 18 of beacon frames broadcasted by AP 10. In some implementations, the network discovery process includes the transmission by STA 18 of a probe request frame and receipt by STA 18 of a probe response frame from AP 10 in response to the probe request frame.

[0022] A server 20 is coupled to AP 10 through network 12. In the present implementation, server 20 is local to AP 10. Alternatively, server 20 may be remote to AP 10, and the coupling of server 20 to AP 10 may occur via other networks in addition to network 12. For example, if server 20 is remote to AP 10, the coupling of server 20 to AP 10 may occur via the Internet.

[0023] As explained in further detail in this disclosure, AP 10 advertises MFQ information that describes how the current MFQ policy in effect in BSS 16 differs from the default MFQ policy, and this advertisement may be received and interpreted by associated STAs, such as STAs 14, and by non-associated STAs, such as STA 18. Upon receipt of the advertised MFQ policy, a classification of management frames of the associated STA may be adjusted in accordance with the advertised MFQ policy. A non-associated STA, such as STA 18, may use Access Network Query Protocol (ANQP) to query an AP, such as AP 10, for the advertised MFQ policy. For example, a non-associated STA that is

actively scanning may issue a probe request or a Generic Advertisement Service (GAS) request on an AP's channel in order to determine what MFQ policy the AP is implementing. However, such a non-associated STA may choose not to follow that MFQ policy. It should be noted that AP 10 transmits management frames according the current MFQ policy in effect (i.e., being implemented) within BSS 16.

[0024] FIG. 2 illustrates an example method to be implemented by an AP for advertisement of MFQ information. At 22, the AP creates an advertisement of MFQ information that describes how the current MFQ policy in effect in the BSS differs from the default MFQ policy. At 24, the AP advertises the advertisement, thus advertising the current MFQ policy in effect in the BSS (i.e., the current MFQ policy). For the sake of simplicity and brevity, the present disclosure discusses one format of the advertisement generated by the AP though those skilled in the art will appreciate that other forms of the advertisement are anticipated.

[0025] In the example method illustrated in FIG. 3, the advertisement is in the form of a MFQ policy element. The MFQ policy element defines access categories of management frames and, as mentioned above, is used to advertise and exchange MFQ policy between a STA and an AP. The AP generates a MFQ policy element at 26. At 28, the AP includes the MFQ policy element in downlink frames, for example, in beacon frames or in probe response frames or in both. As part of the process of generating a beacon frame and as part of the process of generating a probe response frame, the AP may regenerate the MFQ policy element to reflect the current MFQ policy in effect in the BSS. The MFQ policy element is not reused from an earlier beacon frame or probe response frame. Rather, the MFQ policy element is generated as part of the process of generating the beacon frame or probe response frame in which the MFQ policy element is to be included.

[0026] An AP may indicate support for management frame prioritization by setting an appropriate bit, referred to herein as MFQActivated, in the Capabilities field of the Extended Capabilities information element (IE) to a value of 1 or may indicate lack of support for management frame prioritization by setting that bit to a value of 0. One of the currently reserved bits of the Capabilities field of the Extended Capabilities IE (as defined in IEEE Std 802.11-2007) may be used for this purpose. Alternatively, presence of the MFQ policy element in the downlink frame may be an indication to STAs receiving the downlink frame that MFQ is enabled, and lack of presence of the MFQ policy element in the downlink frame may be an indication to STAs receiving the downlink frame that either the AP sending the downlink frame does not support MFQ, or the AP sending the downlink frame supports MFQ and there is no change to the current MFQ policy for the AP to advertise.

[0027] When the AP changes its current MFQ policy in effect in the BSS, the change is communicated in all the beacon frames transmitted during the Delivery Traffic Indication Message (DTIM) interval following the MFQ policy change. The change may be indicated, for example, by setting a change bit to a value of 1. The change bit may be part of the MFQ policy element or may be in another part of the beacon frame. Setting the change bit to 1 in all beacon frames transmitted during the DTIM interval following the MFQ policy change will ensure that most, if not all, STAs in the BSS will be informed of a change in MFQ policy for the BSS. For example, even if a STA is in an awake state only for beacon frames that includes DTIMs and is not awake to receive other beacon frames, that STA will still be informed of the change in MFQ policy, and therefore be prompted to check the MFQ policy element in the beacon frame. However, a STA that has set its ReceiveDTIMs parameter to "No" may not receive a beacon frame that informs of a change in MFQ policy for the BSS.

[0028] FIG. 4 illustrates an example method to be implemented by a STA associated with an AP for handling MFQ information received from the AP in a downlink frame. At 30, the STA receives a downlink frame that includes a MFQ policy element. At 32, the STA configures itself to implement the advertised MFQ policy. In other words, the STA configures itself to implement the default MFQ policy modified by the content of the MFQ policy element. As such, the STA assigns an access category to each management frame according to an access category assignment indicated in the MFQ policy element (i.e., the advertised MFQ policy).

[0029] FIG. 5 illustrates example formatting information for a MFQ policy element. In order that the advertisement may be received by associated STAs and by non-associated STAs, the size of the MFQ policy element complies with any upper limit on the size of an element in non-associated mode. In one implementation, an Element ID field 34 which is 1 octet in length includes a value indicating that the element is a MFQ policy element. A length field 36 which is also 1 octet in length stores the length of the MFQ policy element. The length of the MFQ policy element may vary, because information for multiple deviations from the default MFQ policy may be included in the MFQ policy element. A MFQ policy info field 38, alternatively named "Access Category Assignment Count" field 38, is 1 octet in length and includes a value indicating the number of deviations which are included in the MFQ policy element. MFQ policy info field 38 may also include a change bit to indicate whether the MFQ policy has changed. The "Deviation from default MFQ policy for management frame subtype #1" field 40, alternatively named "Management Prioritization Policy for Category #1" field 40, "Access Category Assignment #1" field 40, or "Access Category Mapping #1" field 40, stores a first deviation to be included in the advertised MFQ policy. Optionally, additional deviations may be provided in fields 42 and 44. Fields 40, 42 and 44 are all of variable length.

[0030] Any one or any combination of the following factors may be taken into account when determining a change to a MFQ policy: detection of changes in network conditions, anticipation of changes in network conditions, detection of

changes in network loading (at the BSS level or at the ESS level or both), anticipation of changes in network loading (at the BSS level or at the ESS level or both), detection of changes in AP loading, anticipation of changes in AP loading, the presence or lack of a multi-media stream, detection of changes in a multi-media stream, anticipation of changes in a multi-media stream, and other operating conditions.

Negotiated MFQ Policy

[0031] An associated non-AP STA may negotiate with the AP with which it is associated in order to deviate from the advertised MFQ policy (i.e., the configured MFQ policy). FIG. 6 illustrates an example method to be performed by a STA associated with an AP for requesting permission from the AP to deviate from the advertised MFQ policy, receiving a response from the AP, and acting on the received response.

[0032] The method begins at 46 with a STA implementing the MFQ policy configured in its MAC sublayer module. At 48, the STA transmits a policy configuration request, also referred to herein as an "MFQ Policy Config Request", to the AP to request a change in the MFQ policy used to transmit management frames between the STA and the AP (i.e., the responding AP). In other words, a MFQ Policy Config Request is used to negotiate a change or modification to the MFQ policy between a STA and an AP with which the STA is associated. The MFQ Policy Config Request transmitted by the STA includes or indicates a change(s) to the MFQ policy being implemented. The policy configuration request may be transmitted in response to a triggering event, for example, a network problem, application-related diagnostics, or a financial transaction. At 50, the STA receives a policy configuration response from the AP.

[0033] The policy configuration request (i.e., the MFQ Policy Config Request) includes a MFQ policy element describing how a requested MFQ policy differs from the default MFQ policy. In other words, the MFQ policy element indicates a proposed change with reference to the default MFQ policy. Any one or any combination of the following factors may taken into account when determining a requested MFQ policy: detection of changes in the associated non-AP STA due to diminishing battery power levels, anticipation of changes in the associated non-AP STA due to diminishing battery power levels, detection that a current predicted motion of the non-AP STA will shortly take the non-AP STA out of radio coverage, so the requested MFQ policy prioritizes signaling frames over a poor link.

[0034] If, as shown at 52, a policy configuration response, also referred to as a "MFQ Policy Config Response", from the AP indicates that a policy configuration request has been rejected by the AP (i.e., the proposed change(s) in the MFQ Policy Config Request has (have) been rejected), the STA that transmitted the request may continue at 46 to transmit management frames in accordance with the MFQ policy configured in its MAC sublayer module.

[0035] In this document, a "negotiated MFQ policy" is a requested MFQ policy requested in a policy configuration request that has been accepted by the AP. If, as shown at 54, a policy configuration response received from the AP indicates that a policy configuration request has been accepted by the AP (i.e., the proposed change(s) in the MFQ Policy Config Request has (have) been accepted), the STA proceeds at 56 to implement the negotiated MFQ policy by configuring its MAC sublayer module to implement the default MFQ policy modified by the content of the policy element (i.e., the proposed changes) in the policy configuration request that has been accepted. In some implementations, both the STA and the AP may transmit management frames to each other in accordance with the changes to the MFQ policy that were indicated in the MFQ Policy Config Request. The negotiated MFQ policy applies only to the associated STA that made the policy configuration request and does not apply to any other STA in the BSS.

[0036] At some point following acceptance of a policy configuration request, the AP may send a policy stop message to the STA that made the policy configuration request. Alternatively, the STA that made the policy configuration request may send a policy stop message to the AP. As long as no policy stop message has been transmitted by the AP to the STA or by the STA to the AP, the STA may continue to implement the negotiated MFQ policy. However, if the STA determines at 58 that a policy stop message has been received from the AP or transmitted by the STA, the STA may at 60 configure its MAC sublayer module according to the MFQ policy currently advertised by the AP. The AP may have changed its advertised MFQ policy during the time that the STA was configured according to the negotiated MFQ policy. After the STA has at 58 received a policy stop message from the AP or transmitted a policy stop message to the AP, the STA may wait for an advertisement of the MFQ policy currently in effect for the BSS in order to configure its MAC sublayer module in accordance with the current advertised MFQ policy.

[0037] Optionally, a policy configuration response received from the AP may indicate that the STA should retry its policy configuration request, as shown at 62. In this case, the policy configuration response may include a suggested MFQ policy (not shown) that the AP might accept upon request. At 64, the STA may transmit another policy configuration request to the AP. This policy configuration request may be the same policy configuration request that was transmitted by the STA at 48, or this policy configuration request may include a MFQ policy element received from the AP describing a suggested MFQ policy (not shown) suggested by the AP, or this policy configuration request may include a different MFQ policy element describing a different MFQ policy than the previously requested MFQ policy. After transmitting the other policy configuration request to the AP at 64, the STA receives a new policy configuration response from the AP at 50.

[0038] As an alternative to use of the policy stop message, a STA that no longer wishes to follow the negotiated MFQ

policy may send to its associated AP a policy configuration request that includes an MFQ policy element identical to the MFQ policy element advertised by the associated AP. It is expected that the AP will accept a policy configuration request that is requesting the MFQ policy currently implemented in the BSS.

[0039] As an alternative to use of the policy stop message, an AP that wants a STA to stop following a negotiated MFQ policy may send to the STA a policy configuration request that includes an MFQ policy element identical to the MFQ policy element advertised by the associated AP. It is expected that the STA will interpret the policy configuration request as a command from the associated AP to stop following the negotiated MFQ policy and to begin following the advertised MFQ policy.

[0040] FIG. 7 illustrates an example method to be performed by an AP for receiving a policy configuration request from an associated STA for permission to deviate from a MFQ policy currently advertised by the AP and for responding to the request.

[0041] The method begins at 66 when the AP receives a policy configuration request from an associated STA. At 68, the AP determines the result of the policy configuration request and includes the result in a policy configuration response to be transmitted to the STA. For example, the AP may determine to accept the policy configuration request or to reject the policy configuration request. Alternatively, the AP may determine that the STA should retry the policy configuration request. In the case that the AP determines that the result of the policy configuration request is retry, the AP may optionally determine at 69 a suggested MFQ policy to include in its policy configuration response to the STA. It is contemplated that such a suggested MFQ policy may be more likely to be accepted by the AP than the requested MFQ policy in the policy configuration request received from the STA at 66.

[0042] Following the AP's determination of the result of the policy configuration request at 66 and its optional determination (if the result is retry) of a suggested MFQ policy to describe in a policy configuration response at 68, the AP transmits the policy configuration response to the STA at 70.

[0043] FIG. 8 illustrates example formatting information for a policy configuration request. A policy configuration request may be implemented as a particular type of management frame called an action frame. A Category field 72 which is 1 octet in length is set to a value for public action. A Public Action field 73 which is 1 octet in length is set to indicate a policy configuration request frame. A dialog token field 74 which is 1 octet in length is set by the STA to a value to enable the STA to keep track of its policy configuration requests. A MFQ policy element 76 field describes the particular MFQ policy that is being requested.

[0044] FIG. 9 illustrates example formatting information for a policy configuration response. A policy configuration response may be implemented as an action frame. Category field 72 is as described above for a policy configuration request. A Public Action field 78 which is 1 octet in length is set to indicate a policy configuration response frame. Dialog token field 74 is as described above for a policy configuration request and has the same value that was used to identify the policy configuration request for which this is a response. A Result Code field 80, alternatively named "Status Code" field 80, includes an indication that the AP accepts or rejects the policy configuration request to which the Dialog Token applies or that the STA should retry a request for a policy. An optional MFQ policy element field 82, applicable when the content of the Result Code field 80 comprises an indication that the STA should retry a request, describes how a suggested MFQ policy differs from the default MFQ policy. The STA may request the suggested MFQ policy in place of the originally requested MFQ policy.

[0045] FIG. 10 illustrates example formatting information for a policy stop message. A policy stop message may be implemented as an action frame. Category field 72 is as described above for a policy configuration request. A Public Action field 84 which is 1 octet in length is set to indicate a policy stop message. Dialog token field 74 is as described above for a policy configuration request and has the same value that was used to identify the policy configuration request for which this is a policy stop message.

Implementation of MFQ Policy (Default, Advertised or Negotiated)

[0046] An AP or non-AP STA may configure its MAC sublayer module to implement an MFQ policy. The MFQ policy being implemented by the MAC sublayer module may be the default MFQ policy. Alternatively, the MFQ policy being implemented by the MAC sublayer module may be the default MFQ modified by an advertised MFQ policy element. Alternatively, the MFQ policy being implemented by the MAC sublayer module may be the default MFQ policy modified by a MFQ policy element in a policy configuration request that has been accepted. While a management frame is generated within the MAC sublayer module, the management frame will be assigned to an access category as defined by the MFQ policy, and subsequently transmitted, using the respective access category. In the present implementation, the management frame is directed, based on its assigned access category, to one of four EDCA prioritized queues where each of the prioritized queues is associated with a respective access category. As such, in the present implementation, a management frame assigned to AC_VO will be transmitted using a prioritization (i.e., a transmission priority) associated with AC_VO, a management frame assigned to AC_VI will be transmitted using a prioritization associated with AC_VI, a management frame assigned to AC_BE will be transmitted using a prioritization associated with AC_BE,

and a management frame assigned to AC_BK will be transmitted using a prioritization associated with AC_BK. In other words, each access category (e.g., AC_VO, AC_VI, AC_BE and AC_BK) is indicative of a distinct prioritization (i.e., transmission priority) used to transmit a particular type or subtype of management frame. Handling of the contents of the prioritized queues may follow IEEE 802.11 scheduling and transmission rules. For example, a frame scheduler schedules frames from the prioritized queues to be passed to the physical (PHY) sublayer module for transmission over a channel of a wireless medium.

[0047] FIG. 11 is a block diagram of an example AP 100. AP 10 is an example of AP 100. AP 100 comprises a processor 102 coupled to a memory 104 and to a communication interface 106. Communication interface 106 may be a wired communication interface, a satellite interface, a Worldwide Interoperability for Microwave Access (WiMAX®) communication interface, or any other suitable communication interface. AP 100 also comprises a WLAN interface 108 within a protocol stack 110 that is coupled to processor 102. WLAN interface 108 comprises a logical link control (LLC) sublayer module 112, a MAC sublayer module 114 and a PHY sublayer module 116. The BSSID of AP 100 is stored in WLAN interface 108, possibly in a register 118. The SSID of the WLAN supported by AP 100 is stored in WLAN interface 108, possibly in a register 120. MAC sublayer module 114 may be compatible with IEEE 802.11. AP 100 also comprises an antenna 122 coupled to PHY sublayer module 116. Protocol stack 110 may comprise higher layers 124. ANQP support may be implemented in MAC sublayer module 114.

[0048] Memory 104 may store an operating system 126 to be executed by processor 102. Memory 104 may store applications 128 installed in AP 100 to be executed by processor 102. Examples of applications 128 include a configuration application that enables a WLAN administrator to configure parameters of the WLAN, for example, its SSID and BSSID(s). Memory 104 may store code 130 which, when executed by processor 102, results in one or more of the methods illustrated in FIGs. 2, 3, and 7.

[0049] A default MFQ policy 132 is not advertised in the BSS. Depending upon implementation, default MFQ policy 132 may be stored in WLAN interface 108 (as illustrated) or in memory 104. Depending upon implementation, an advertised MFQ policy 133 currently implemented by WLAN MAC sublayer 114 may be stored in WLAN interface 108 (as illustrated) or in memory 104. AP 100 is able to advertise how advertised MFQ policy 133 differs from default MFQ policy 132. AP 100 may optionally store data 134 related to one or more policy configuration requests that have previously been received from one or more associated STAs and related to one or more policy configuration responses that have previously been transmitted to one or more associated STAs. Data 134 may be implemented, for example, as records in a table, where the records are maintained on a per-AID (association identifier) basis. Depending upon implementation, data 134 may be stored in WLAN interface 108 (as illustrated) or in memory 104.

[0050] AP 100 may comprise other elements that, for clarity, are not illustrated in FIG. 11. Similarly, AP 100 may comprise a subset of the elements illustrated in FIG. 11.

[0051] FIG. 12 is a block diagram of an example STA, for example, any one of STAs 14. An STA 200 comprises a processor 202 coupled to a memory 204 and optionally to one or more other wireless communication interfaces 206. For example, wireless communication interfaces 206 may comprise a short-range wireless communication interface such as a wireless personal area network interface, possibly compatible with the Bluetooth Specification Version 4.0 published 30 June 2010 or its official successors. In another example, wireless communication interfaces 206 may comprise a wireless wide area network (WWAN) interface such as for cellular communications. One or more antennas 208 may be coupled to respective ones of the wireless communication interfaces 206. An antenna may be shared among more than one wireless interface.

[0052] STA 200 also comprises a WLAN interface 210 within a protocol stack 212 that is coupled to processor 202. WLAN interface 210 comprises a LLC sublayer module 214, a MAC sublayer module 216 and a PHY sublayer module 218. MAC sublayer module 216 may be compatible with IEEE 802.11. STA 200 also comprises an antenna 220 coupled to PHY sublayer module 218. Protocol stack 212 may comprise higher layers 222.

[0053] Memory 204 may store an operating system 224 to be executed by processor 202. Memory 204 may store applications 226 installed in STA 200 to be executed by processor 202. For example, applications 226 may comprise a control application to act on MFQ policy elements received from an AP. In a further example, applications 226 may comprise a Voice over Internet Protocol (VoIP) application. In yet another example, applications 226 may comprise a telephony application. Memory 204 may also store data (not shown) used by operating system 224 and applications 226.

[0054] Memory 204 may store one or more WLAN connection profiles 228, each identifying a wireless local area network by its SSID, as known in the art.

[0055] Memory 204 may store code 230 which, when executed by processor 202, results in one or more of the methods illustrated in FIGs. 4 and 6. Receipt of a downlink frame and handling of MFQ information describing an advertised MFQ policy may be implemented in MAC sublayer module 216. ANQP support may be implemented in MAC sublayer module 216.

[0056] A default MFQ policy 232 is not advertised in the BSS. Depending upon implementation, default MFQ policy 232 may be stored in WLAN interface 210 (as illustrated) or in memory 204. Depending upon implementation, a MFQ policy 233 currently implemented by WLAN MAC sublayer 216 may be stored in WLAN interface 210 (as illustrated) or

in memory 204. STA 200 may optionally store data 234 related to one or more policy configuration requests made by the STA and related to one or more policy configuration responses received by the STA. STA 200 may store an indication of its requested MFQ policy and then overwrite currently implemented MFQ policy 233 with the negotiated MFQ policy upon receiving acceptance of the policy configuration request.

[0057] Memory 204 may store an audio coder-decoder (codec) 238 or a video codec 240 or both. STA 200 may comprise an audio input element 242 and an audio output element 244, both coupled to processor 202. STA 200 may comprise a video input element 246 and a video output element 248, both coupled to processor 202.

[0058] STA 200 may comprise a Global Positioning System (GPS) module 250 coupled to processor 202.

[0059] STA 200 may comprise one or more user input elements 252 coupled to processor 202. Examples of user input elements include a keyboard, a keypad, a touchscreen, a joystick, a thumbwheel, a roller, a touchpad, a trackpad, a capacitive touch pad, an optical touch pad, and any other type of navigation actuator.

[0060] STA 200 may comprise one or more user output elements coupled to processor 202, of which a display 254 is illustrated. In the event that display 254 is a touchscreen, it functions also as a user input element.

[0061] STA 200 may comprise one or more alert components 256 coupled to processor 202, to be activated in order to alert a user, for example, by sounding a buzzer, playing a ringtone, emanating light, or vibrating.

[0062] STA 200 may include mechanical interfaces, such as a power connector jack, a data interface port such as a Universal Serial Bus (USB) port, a headphone jack, and other mechanical interfaces that are not explicitly shown.

[0063] STA 200 comprises a power pack 258 that provides power to the other components of STA 200.

[0064] STA 200 may comprise other elements that, for clarity, are not illustrated in FIG. 12. Similarly, STA 200 may comprise a subset of the elements illustrated in FIG. 12.

[0065] FIG. 13 is a block diagram of a MAC sublayer module 300 of an AP, for example, MAC sublayer module 114 of AP 100. MAC sublayer module 300 uses a management frame generator 302 to generate management frames which are distributed to different memory queues by a management frame classification unit 304. Distribution to the different memory queues is done according to a MFQ policy 306 currently implemented in the BSS to which the AP belongs. Management frames of the type or types for which MFQ policy 306 defines the access category AC_VO are routed by management frame classification unit 304 through memory queue 308. Management frames of the type or types for which MFQ policy 306 defines the access category AC_VI are routed by management frame classification unit 304 through memory queue 310. Management frames of the type or types for which MFQ policy 306 defines the access category AC_BE are routed by management frame classification unit 304 through memory queue 312. Management frames of the type or types for which MFQ policy 306 defines the access category AC_BK are routed by management frame classification unit 304 through memory queue 314. In some implementations, MFQ policy 306 defines an access category other than the AC_VO access category associated with the highest priority queue 308 for at least one management frame type.

[0066] Data frames (content frames and signaling frames) received at MAC sublayer module 300 from an LLC sublayer module (not shown) of the AP, for example, LLC sublayer module 112, may be processed by a packet classification, fragmentation and encapsulation module 316 in MAC sublayer module 300 and then subsequently routed through the same memory queues as the management frames.

[0067] A scheduler 318 schedules frames from memory queues 308, 310, 312 and 314 to be passed to a PHY sublayer module of the AP, for example, PHY sublayer module 116. For example, IEEE 802.11e has separate minimum and maximum values for each access category. Within each access category, a random number is generated that represents a wait time as multiplied by a "slot time". In IEEE 802.11a/g, a slot time is 9 microseconds. Once the wireless medium is quiet or unoccupied, a countdown begins before transmission. Each count is 9 microseconds in real time. For AC_VO queue 308, the countdown begins at a value between 31 and 127. For AC_VI queue 310, the countdown begins at a value between 127 and 255. For AC_BE queue 312, the countdown begins at a value between 255 and 511. For AC_BK queue 314, the countdown begins at a value between 511 and 1023. If the countdown is interrupted, it is paused until the wireless medium is once again quiet, and is then resumed from the value at which it was paused. If the countdowns for different queues begin at the same time, traffic in a higher priority queue will gain access to the wireless medium ahead of traffic in a lower priority queue.

[0068] MAC sublayer module 300 further comprises a MFQ policy element generator 320 which generates a MFQ policy element based on MFQ policy 306. As described previously, a MFQ policy element may be included in certain management frames generated by management frame generator 302 to advertise an advertised MFQ policy. For example, a MFQ policy element generated by MFQ policy element generator 320 may be included in a downlink frame such as a beacon frame or a probe response frame that is generated by management frame generator 302. It should be noted that, while not explicitly shown, MAC sublayer module 300 may also implement ANQP support.

[0069] FIG. 14 is a block diagram of a MAC sublayer module 400 of a STA, for example, MAC sublayer module 216 of STA 200. MAC sublayer module 400 uses a management frame generator 402 to generate management frames which are distributed to different memory queues by a management frame mapping unit 404. Distribution to the different memory queues is done according to a MFQ policy 406. Management frames of the type or types for which MFQ policy

406 defines the access category AC_VO are routed by management frame classification unit 404 through memory queue 408. Management frames of the type or types for which MFQ policy 406 defines the access category AC_VI are routed by management frame classification unit 404 through memory queue 410. Management frames of the type or types for which MFQ policy 406 defines the access category AC_BE are routed by management frame classification unit 404 through memory queue 412. Management frames of the type or types for which MFQ policy 406 defines the access category AC_BK are routed by management frame classification unit 404 through memory queue 414. In some implementations, MFQ policy 406 defines an access category other than the AC_VO access category associated with the highest priority queue 408 for at least one management frame type.

[0070] It is contemplated that MFQ policy 406 is an advertised MFQ policy. It is also contemplated that MFQ policy 406 is a negotiated MFQ policy accepted by an AP with which the STA is associated. It is also contemplated that MFQ policy 406 is the default MFQ policy.

[0071] Data frames (content frames and signaling frames) received at MAC sublayer module 400 from an LLC sublayer module (not shown) of the STA, for example, LLC sublayer module 214, may be processed by a packet classification, fragmentation and encapsulation module 416 in MAC sublayer module 400 and then subsequently routed through the same memory queues as the management frames.

[0072] A scheduler 418 schedules frames from memory queues 408, 410, 412 and 414 to be passed to a PHY sublayer module of the STA, for example, PHY sublayer module 218. For example, IEEE 802.11e has separate minimum and maximum values for each access category. Within each access category, a random number is generated that represents a wait time as multiplied by a "slot time". In IEEE 802.11a/g, a slot time is 9 microseconds. Once the wireless medium is quiet or unoccupied, a countdown begins before transmission. Each count is 9 microseconds in real time. For AC_VO queue 408, the countdown begins at a value between 31 and 127. For AC_VI queue 410, the countdown begins at a value between 127 and 255. For AC_BE queue 412, the countdown begins at a value between 255 and 511. For AC_BK queue 414, the countdown begins at a value between 511 and 1023. If the countdown is interrupted, it is paused until the wireless medium is once again quiet, and is then resumed from the value at which it was paused. If the countdowns for different queues begin at the same time, traffic in a higher priority queue will gain access to the wireless medium ahead of traffic in a lower priority queue.

[0073] MAC sublayer module 400 further comprises a MFQ policy element generator 420 which generates a MFQ policy element based on a requested MFQ policy. As described previously, the MFQ policy element may be included in a policy configuration request generated by management frame generator 402 to negotiate a deviation from an advertised MFQ policy. It should be noted that, while not explicitly shown, MAC sublayer module 400 may also implement ANQP support.

[0074] Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

Claims

1. A method for a mobile-station (14,200), the method comprising:

   receiving, from an access point (10,100), an extended capabilities element having an indication of support of prioritization of management frames;
   receiving (30), from the access point, a management frame quality of service 'MFQ' policy (133) that defines an access category used for transmitting a first type of management frame, wherein management frames are distinct from signaling frames and content frames;
   transmitting (48) a policy configuration request (234) to request a change to the MFQ policy;
   wherein the MFQ policy (133) comprises an MFQ policy element including an element ID field identifying the MFQ policy element, a length field indicating the length of the MFQ policy element, a policy information field indicating a number of differences from a default MFQ policy.

2. The method as claimed in claim 1, wherein the policy configuration request includes a MFQ policy element indicative of the requested change.

3. The method as claimed in claim 1, further comprising:

   receiving (50), from the access point, a policy configuration response in response to the policy configuration request.

4. The method as claimed in claim 3, wherein the policy configuration response includes an indication that the change has been accepted (54) by the access point.

5. The method as claimed in claim 4, further comprising:

transmitting (60) management frames of the first type in accordance with the change to the MFQ policy after receiving the policy configuration response indicating that the change has been accepted.

6. The method as claimed in claim 3, wherein the policy configuration response includes an indication that the change has been rejected (52) by the access point.

7. The method as claimed in claim 6, further comprising:

transmitting (46) management frames of the first type in accordance with the MFQ policy after receiving the policy configuration response indicating that the change has been rejected.

8. A mobile-station (14,200) configured to implement the method of any of claims 1 to 7.

9. An access point (10,100) comprising:

a processor (102) configured to:

transmit, by the access point, an extended capabilities element having an indication of support of prioritization of management frames;
transmit (24), by the access point, a management frame quality of service 'MFQ' policy (133) that defines an access category used for transmitting a first type of management frame, wherein management frames are distinct from signaling frames and content frames; and
receive (66), from a mobile station (14,200), a policy configuration request (134) to request a change to the MFQ policy (133);

wherein the MFQ policy (133) comprises an MFQ policy element including an element ID field identifying the MFQ policy element, a length field indicating the length of the MFQ policy element, a policy information field indicating a number of differences from a default MFQ policy.

10. The access point as claimed in claim 9, wherein the policy configuration request includes a MFQ policy element indicative of the requested change.

11. The access point as claimed in claim 9, wherein the processor is further configured to:

transmit (70), to the mobile-station, a policy configuration response to the mobile station in response to the policy configuration request.

12. The access point as claimed in claim 11, wherein the policy configuration response includes an indication that the change has been accepted by the access point.

13. The access point as claimed in claim 11, wherein the policy configuration response includes an indication that the change has been rejected by the access point.

Patentansprüche

1. Verfahren für eine Mobilstation (14, 200), wobei das Verfahren Folgendes umfasst:

Empfangen, von einem Zugangspunkt (10, 100), eines Elementes für erweiterte Fähigkeiten mit einer Angabe für die Unterstützung der Priorisierung von Verwaltungsframes;
Empfangen (30), von dem Zugangspunkt, einer Verwaltungsframe-Dienstqualität (MFQ - *Management Frame Quality of Service*) -Strategie (133), die eine Zugangskategorie definiert, die für das Senden eines ersten Typs von Verwaltungsframe verwendet wird, wobei sich Verwaltungsframes von Signalisierungsframes und Inhalts-

frames unterscheiden;
Senden (48) einer Strategiekonfigurationsanfrage (234) zum Anfordern einer Änderung in der MFQ-Strategie; wobei die MFQ-Strategie (133) ein MFQ-Strategieelement umfasst, das ein Element-ID-Feld, welches das MFQ-Strategieelement identifiziert, ein Längenfeld, welches die Länge des MFQ-Strategieelementes angibt, ein Strategieinformationsfeld, welches eine Zahl von Unterschieden gegenüber einer voreingestellten MFQ-Strategie angibt, beinhaltet.

2. Verfahren nach Anspruch 1, wobei die Strategiekonfigurationsanfrage ein MFQ-Strategieelement beinhaltet, das die angeforderte Änderung angibt.

3. Verfahren nach Anspruch 1, welches ferner Folgendes umfasst:

Empfangen (50), von dem Zugangspunkt, einer Strategiekonfigurationsantwort als Reaktion auf die Strategiekonfigurationsanfrage.

4. Verfahren nach Anspruch 3, wobei die Strategiekonfigurationsantwort eine Angabe beinhaltet, dass die Änderung durch den Zugangspunkt akzeptiert wurde (54).

5. Verfahren nach Anspruch 4, welches ferner Folgendes umfasst:

Senden (60) von Verwaltungsframes des ersten Typs in Übereinstimmung mit der Änderung in der MFQ-Strategie nach Empfang der Strategiekonfigurationsantwort, die angibt, dass die Änderung akzeptiert wurde.

6. Verfahren nach Anspruch 3, wobei die Strategiekonfigurationsantwort eine Angabe beinhaltet, dass die Änderung durch den Zugangspunkt zurückgewiesen wurde (52).

7. Verfahren nach Anspruch 6, welches ferner Folgendes umfasst:

Senden (46) von Verwaltungsframes des ersten Typs in Übereinstimmung mit der MFQ-Strategie nach Empfang der Strategiekonfigurationsantwort, die angibt, dass die Änderung zurückgewiesen wurde.

8. Mobilstation (14, 200), die zum Implementieren des Verfahrens nach einem der Ansprüche 1 bis 7 konfiguriert ist.

9. Zugangspunkt (10, 100), welcher Folgendes umfasst:

einen Prozessor (102), der zu Folgendem konfiguriert ist:

Senden, durch den Zugangspunkt, eines Elementes für erweiterte Fähigkeiten mit einer Angabe für die Unterstützung der Priorisierung von Verwaltungsframes;
Senden (24), durch den Zugangspunkt, einer Verwaltungsframe-Dienstqualität (MFQ - *Management Frame Quality of Service*) -Strategie (133), die eine Zugangskategorie definiert, die für das Senden eines ersten Typs von Verwaltungsframe verwendet wird, wobei sich Verwaltungsframes von Signalisierungsframes und Inhaltsframes unterscheiden; und
Empfangen (66), von einer Mobilstation (14, 200), einer Strategiekonfigurationsanfrage (134) zum Anfordern einer Änderung der MFQ-Strategie (133);

wobei die MFQ-Strategie (133) ein MFQ-Strategieelement umfasst, das ein Element-ID-Feld, welches das MFQ-Strategieelement identifiziert, ein Längenfeld, welches die Länge des MFQ-Strategieelementes angibt, ein Strategieinformationsfeld, welches eine Zahl von Unterschieden gegenüber einer voreingestellten MFQ-Strategie angibt, beinhaltet.

10. Zugangspunkt nach Anspruch 9, wobei die Strategiekonfigurationsanfrage ein MFQ-Strategieelement beinhaltet, welches die angeforderte Änderung angibt.

11. Zugangspunkt nach Anspruch 9, wobei der Prozessor ferner zu Folgendem konfiguriert ist:

Senden (70), an die Mobilstation, einer Strategiekonfigurationsantwort an die Mobilstation als Reaktion auf die Strategiekonfigurationsanfrage.

12. Zugangspunkt nach Anspruch 11, wobei die Strategiekonfigurationsantwort eine Angabe beinhaltet, dass die Änderung durch den Zugangspunkt akzeptiert wurde.

13. Zugangspunkt nach Anspruch 11, wobei die Strategiekonfigurationsantwort eine Angabe beinhaltet, dass die Änderung durch den Zugangspunkt zurückgewiesen wurde.

Revendications

1. Procédé pour une station mobile (14, 200), le procédé comprenant :

la réception, en provenance d'un point d'accès (10, 100), d'un élément capacités étendues ayant une indication de support de priorisation de trames de gestion ;
la réception (30), en provenance du point d'accès, d'une politique de qualité de service de trame de gestion 'MFQ' (133) qui définit une catégorie d'accès utilisée pour transmettre un premier type de trame de gestion, où des trames de gestion sont distinctes de trames de signalisation et de trames de contenu ;
la transmission (48) d'une demande de configuration de politique (234) pour demander un changement de la politique MFQ ;
dans lequel la politique MFQ (133) comprend un élément de politique MFQ incluant un champ ID d'élément identifiant l'élément de politique MFQ, un champ longueur indiquant la longueur de l'élément de politique MFQ, un champ informations de politique indiquant un nombre de différences par rapport à une politique MFQ par défaut.

2. Procédé selon la revendication 1, dans lequel la demande de configuration de politique inclut un élément de politique MFQ indicatif du changement demandé.

3. Procédé selon la revendication 1, comprenant en outre :

la réception (50), en provenance du point d'accès, d'une réponse de configuration de politique en réponse à la demande de configuration de politique.

4. Procédé selon la revendication 3, dans lequel la réponse de configuration de politique inclut une indication selon laquelle le changement a été accepté (54) par le point d'accès.

5. Procédé selon la revendication 4, comprenant en outre :

la transmission (60) de trames de gestion du premier type conformément au changement de la politique MFQ après la réception de la réponse de configuration de politique indiquant que le changement a été accepté.

6. Procédé selon la revendication 3, dans lequel la réponse de configuration de politique inclut une indication selon laquelle le changement a été rejeté (52) par le point d'accès.

7. Procédé selon la revendication 6, comprenant en outre :

la transmission (46) de trames de gestion du premier type conformément à la politique MFQ après la réception de la réponse de configuration de politique indiquant que le changement a été rejeté.

8. Station mobile (14, 200) configurée pour mettre en oeuvre le procédé de l'une quelconque des revendications 1 à 7.

9. Point d'accès (10, 100) comprenant :

un processeur (102) configuré pour :

transmettre, par le point d'accès, un élément capacités étendues ayant une indication de support de priorisation de trames de gestion ;
transmettre (24), par le point d'accès, une politique de qualité de service de trame de gestion 'MFQ' (133) qui définit une catégorie d'accès utilisée pour transmettre un premier type de trame de gestion, où des trames de gestion sont distinctes de trames de signalisation et de trames de contenu ; et

recevoir (66), en provenance d'une station mobile (14, 200), une demande de configuration de politique (134) pour demander un changement de la politique MFQ (133) ;

dans lequel la politique MFQ (133) comprend un élément de politique MFQ incluant un champ ID d'élément identifiant l'élément de politique MFQ, un champ longueur indiquant la longueur de l'élément de politique MFQ, un champ informations de politique indiquant un nombre de différences par rapport à une politique MFQ par défaut.

10. Point d'accès selon la revendication 9, dans lequel la demande de configuration de politique inclut un élément de politique MFQ indicatif du changement demandé.

11. Point d'accès selon la revendication 9, dans lequel le processeur est en outre configuré pour :

transmettre (70), à la station mobile, une réponse de configuration de politique à la station mobile en réponse à la demande de configuration de politique.

12. Point d'accès selon la revendication 11, dans lequel la réponse de configuration de politique inclut une indication selon laquelle le changement a été accepté par le point d'accès.

13. Point d'accès selon la revendication 11, dans lequel la réponse de configuration de politique inclut une indication selon laquelle le changement a été rejeté par le point d'accès.

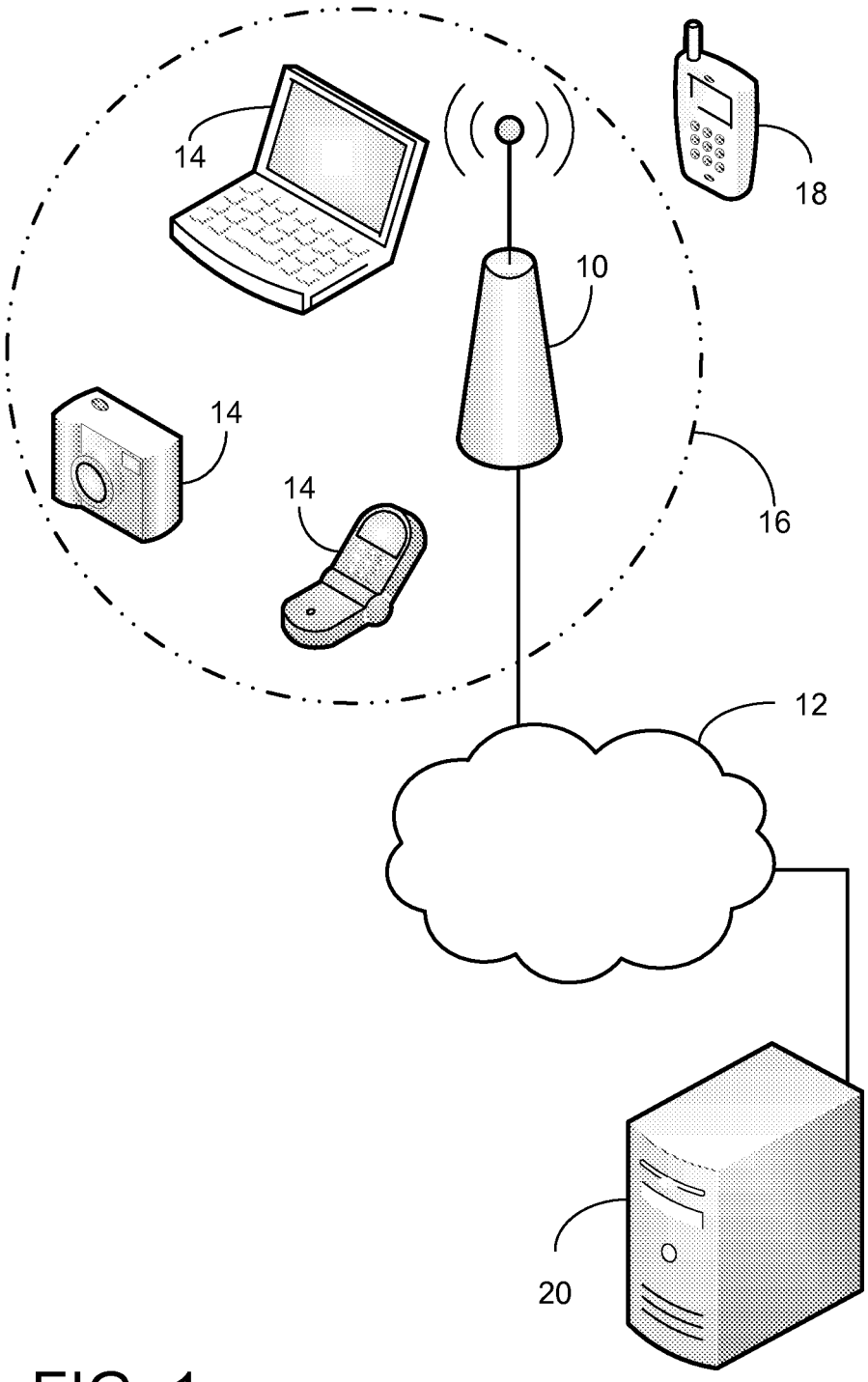


FIG. 1

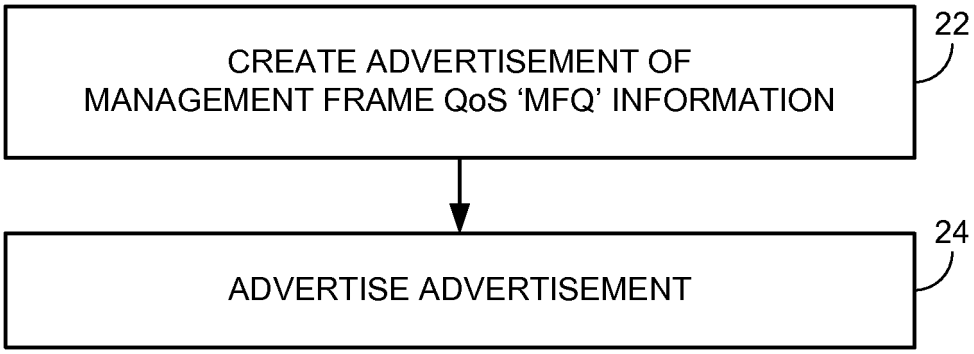


FIG. 2

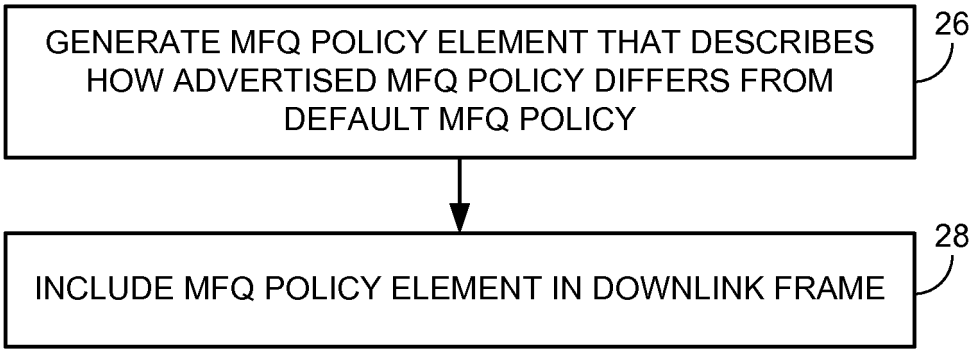


FIG. 3

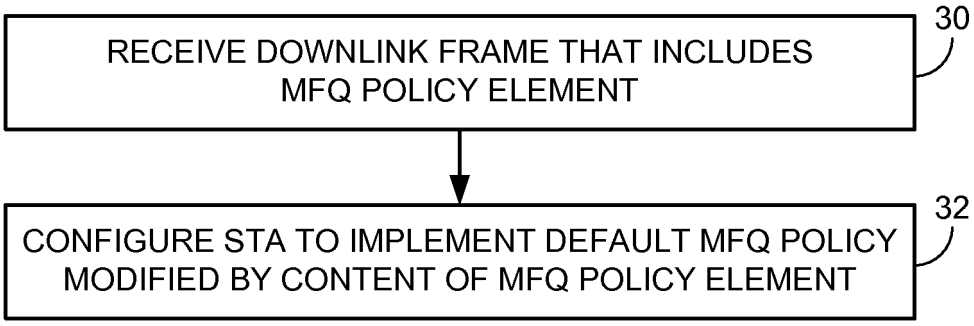


FIG. 4

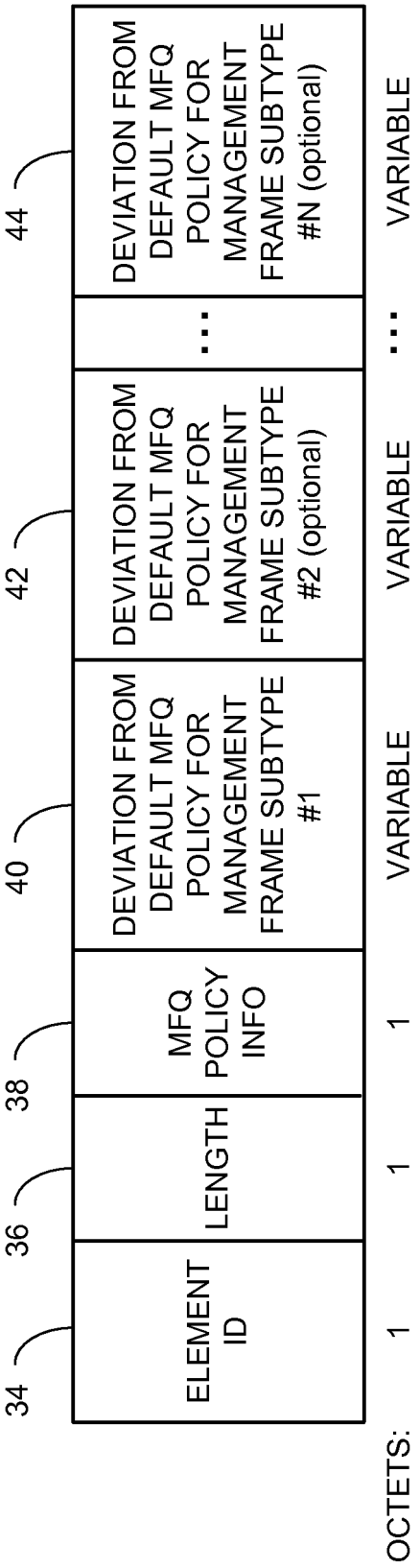

34
36
38
40
42
44
ELEMENT ID
LENGTH
MFQ POLICY INFO
DEVIATION FROM DEFAULT MFQ POLICY FOR MANAGEMENT FRAME SUBTYPE #1
DEVIATION FROM DEFAULT MFQ POLICY FOR MANAGEMENT FRAME SUBTYPE #2 (optional)
...
DEVIATION FROM DEFAULT MFQ POLICY FOR MANAGEMENT FRAME SUBTYPE #N (optional)
OCTETS:
1
1
1
VARIABLE
VARIABLE
...
VARIABLE

FIG. 5

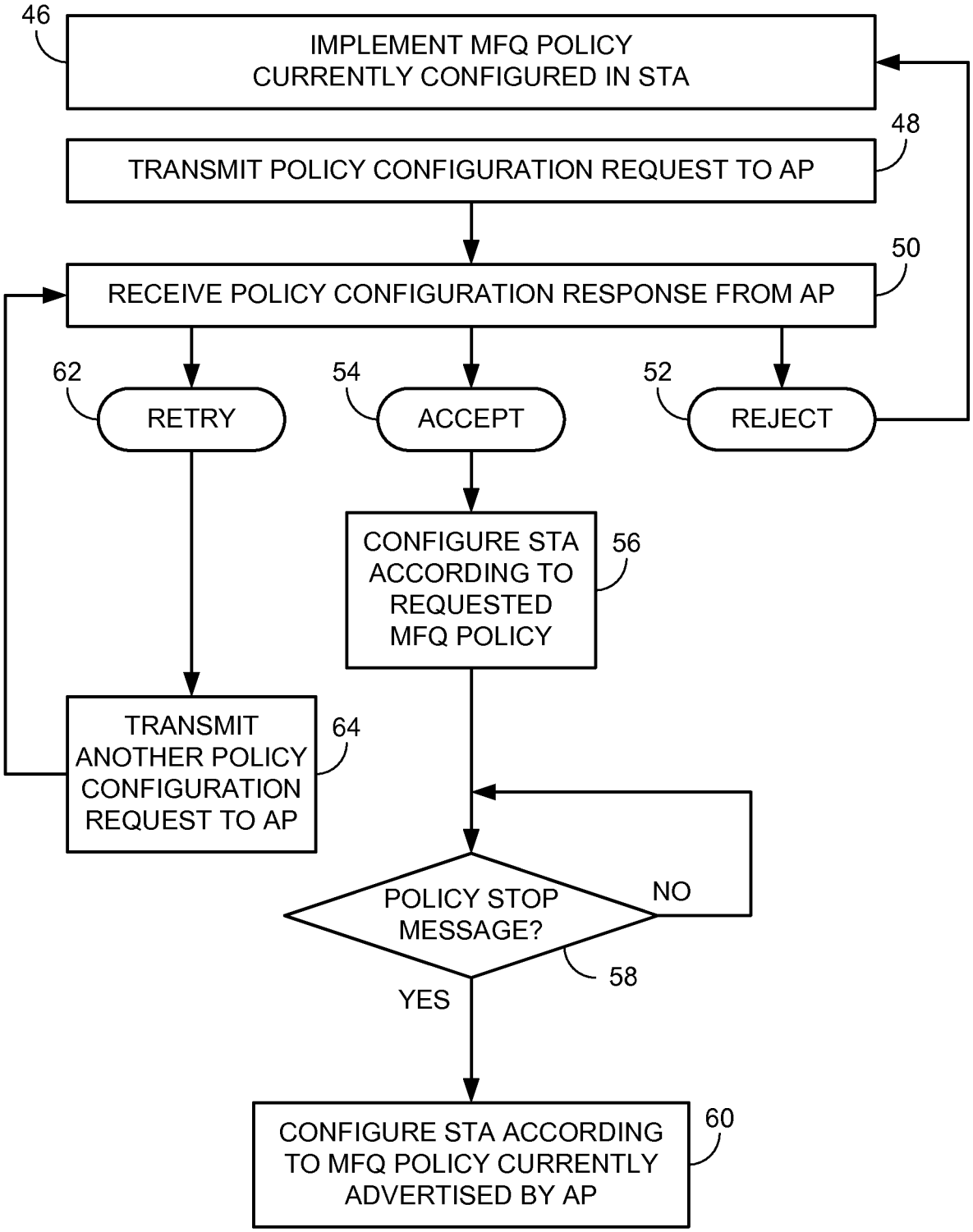

46
IMPLEMENT MFQ POLICY CURRENTLY CONFIGURED IN STA
48
TRANSMIT POLICY CONFIGURATION REQUEST TO AP
50
RECEIVE POLICY CONFIGURATION RESPONSE FROM AP
62
RETRY
54
ACCEPT
52
REJECT
CONFIGURE STA ACCORDING TO REQUESTED MFQ POLICY
56
TRANSMIT ANOTHER POLICY CONFIGURATION REQUEST TO AP
64
POLICY STOP MESSAGE?
NO
58
YES
CONFIGURE STA ACCORDING TO MFQ POLICY CURRENTLY ADVERTISED BY AP
60

FIG. 6

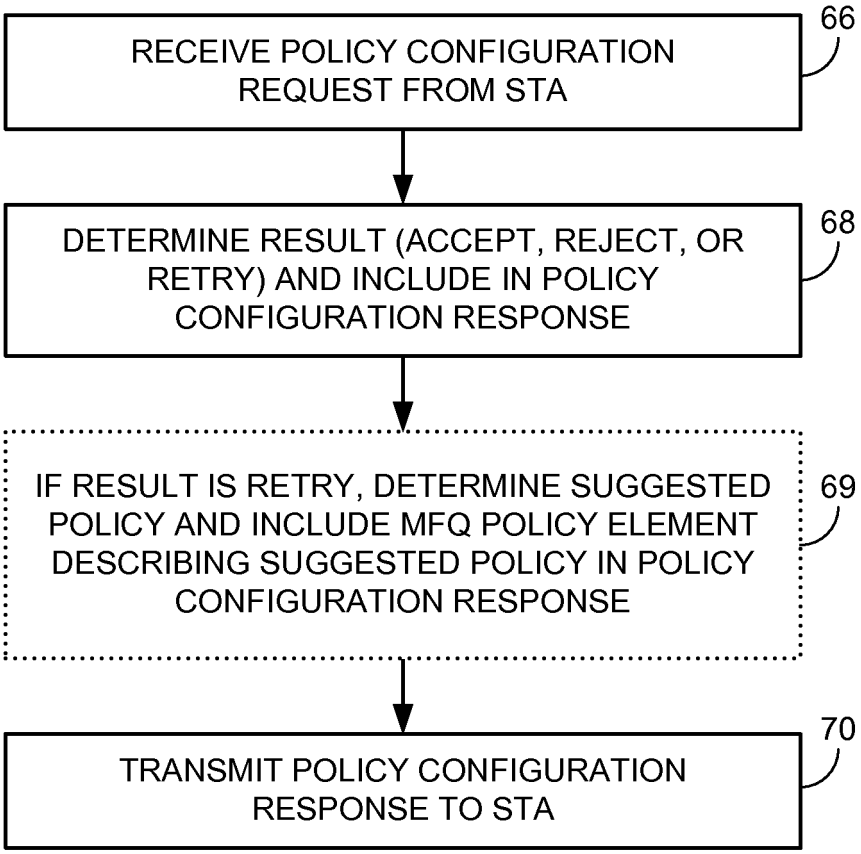

RECEIVE POLICY CONFIGURATION REQUEST FROM STA
66
DETERMINE RESULT (ACCEPT, REJECT, OR RETRY) AND INCLUDE IN POLICY CONFIGURATION RESPONSE
68
IF RESULT IS RETRY, DETERMINE SUGGESTED POLICY AND INCLUDE MFQ POLICY ELEMENT DESCRIBING SUGGESTED POLICY IN POLICY CONFIGURATION RESPONSE
69
TRANSMIT POLICY CONFIGURATION RESPONSE TO STA
70

FIG. 7

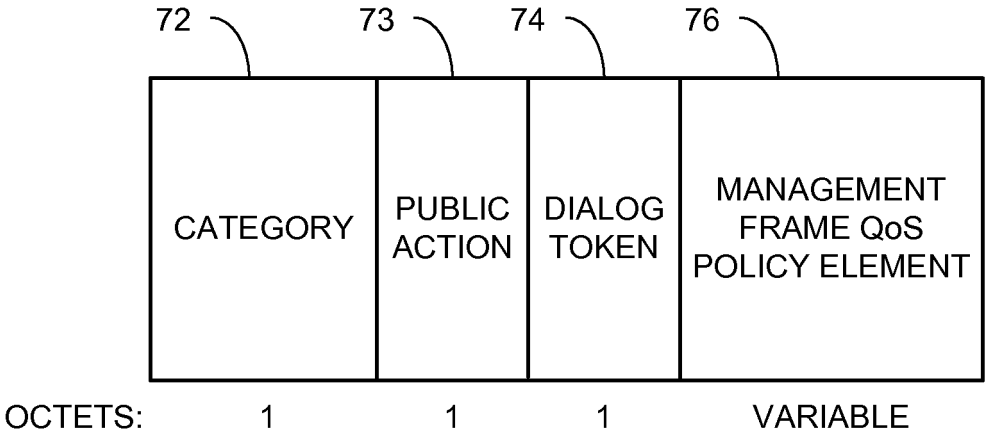


FIG. 8

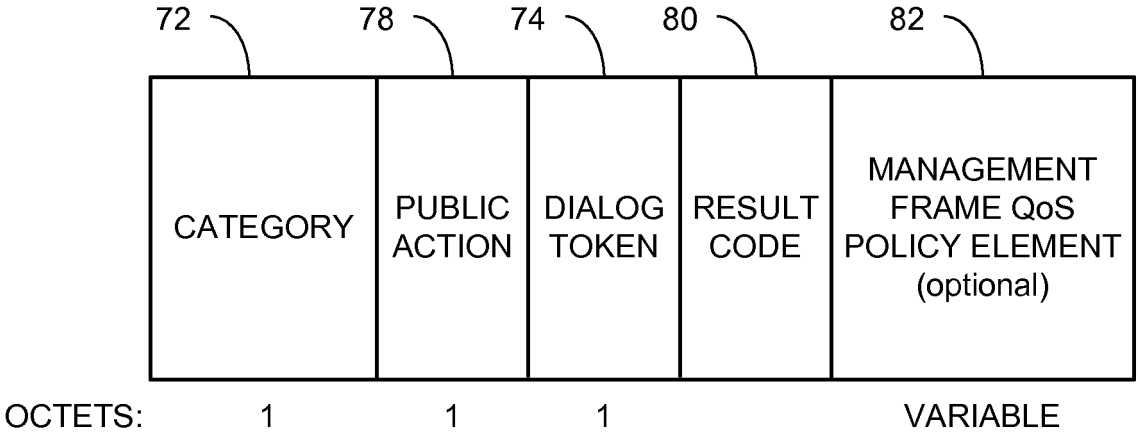


FIG. 9

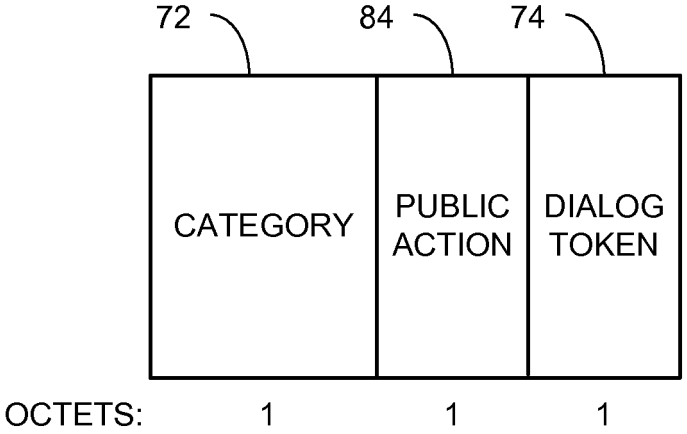


FIG. 10

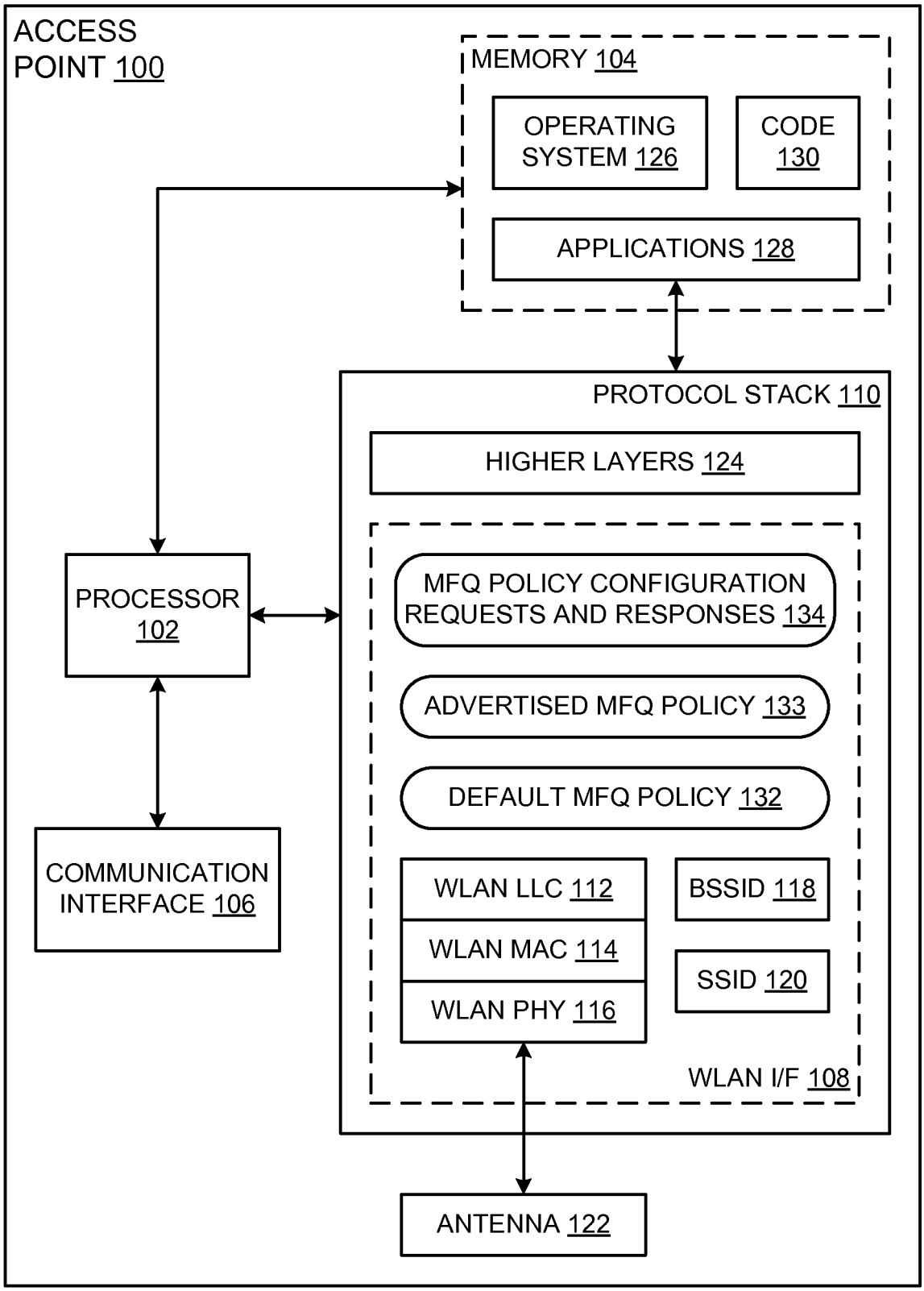

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WLAN LLC 112
BSSID 118
WLAN MAC 114
SSID 120
WLAN PHY 116
WLAN I/F 108
ANTENNA 122

FIG. 11

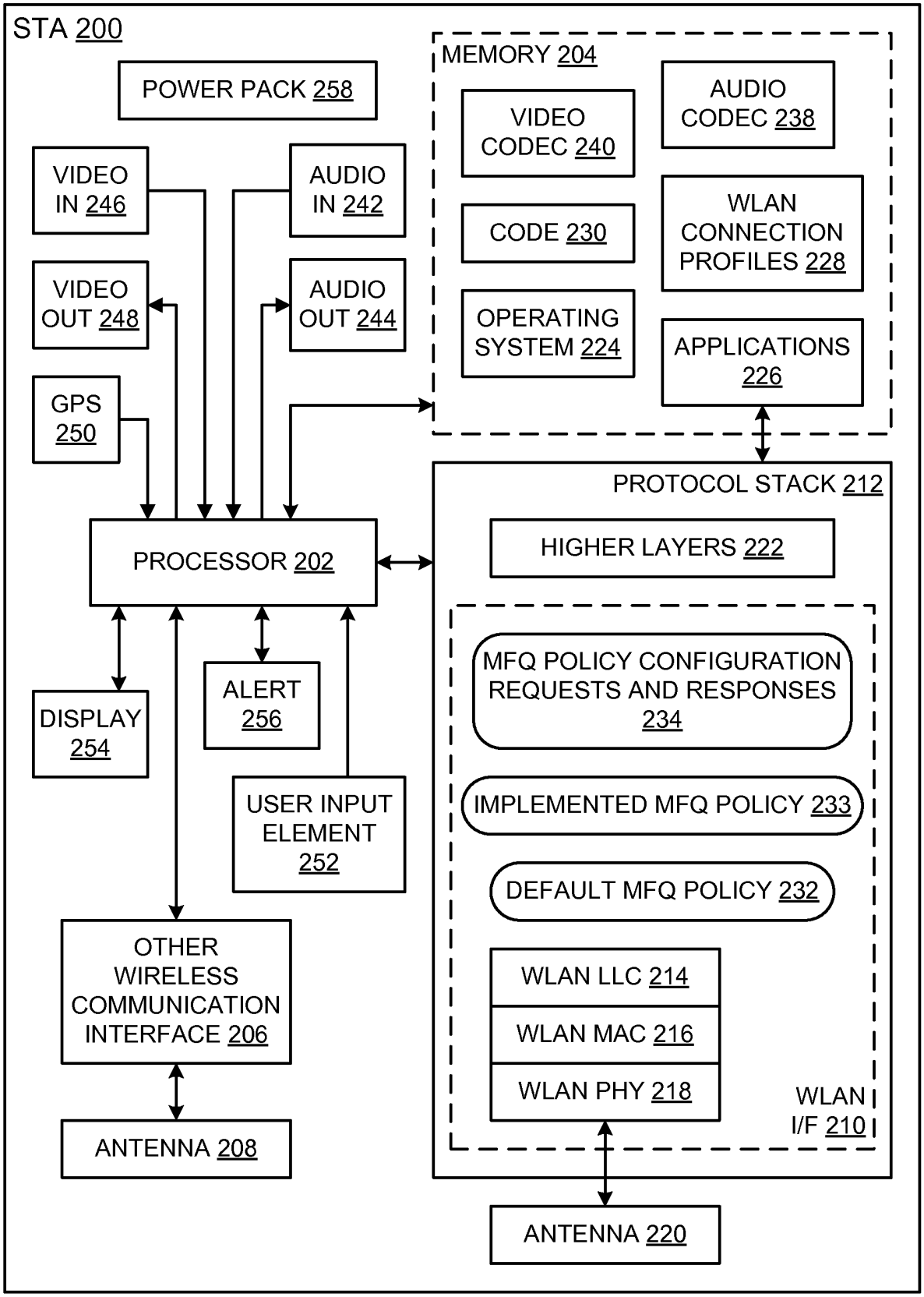

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FIG. 12

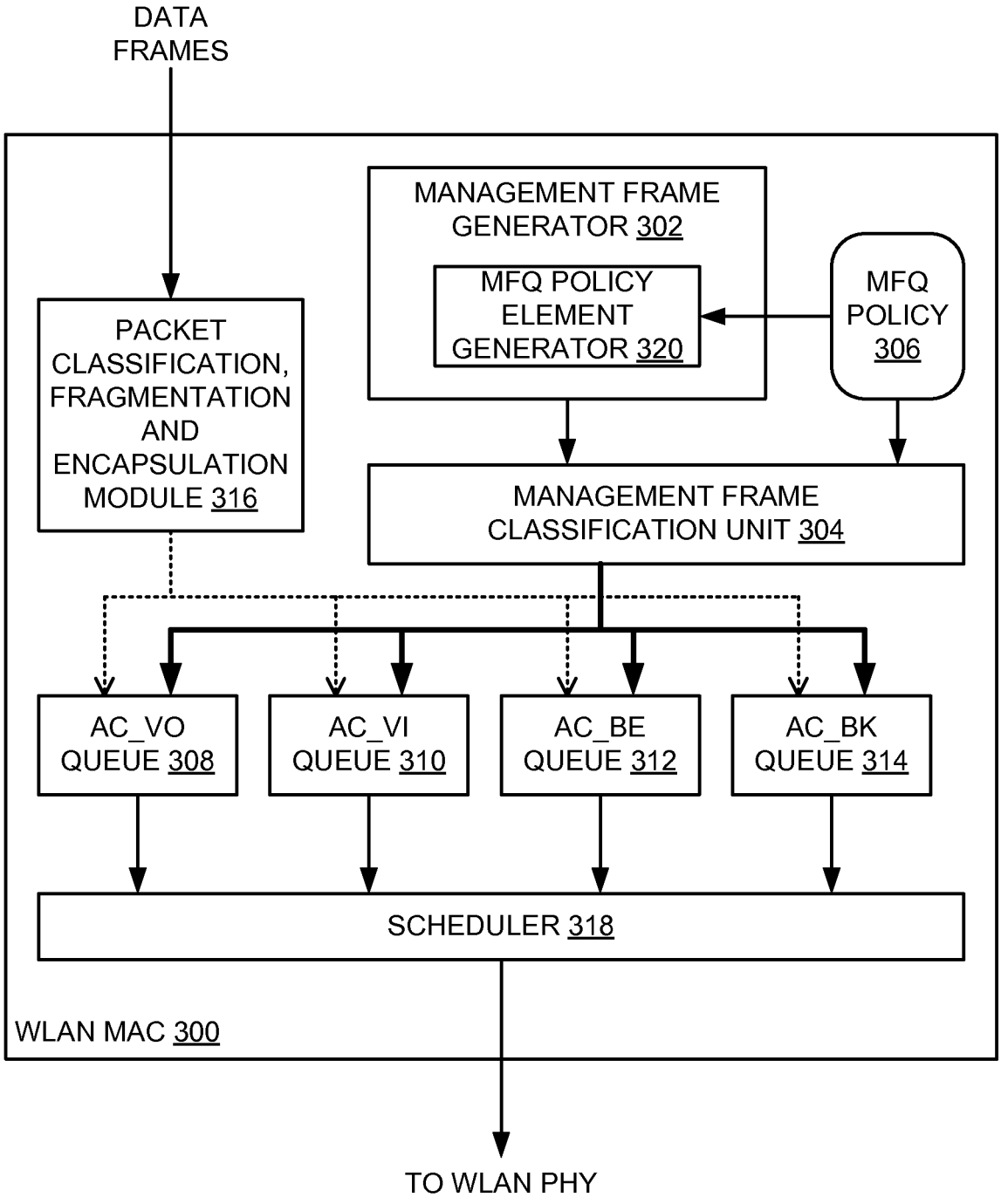

DATA FRAMES
MANAGEMENT FRAME GENERATOR 302
MFQ POLICY ELEMENT GENERATOR 320
MFQ POLICY 306
PACKET CLASSIFICATION, FRAGMENTATION AND ENCAPSULATION MODULE 316
MANAGEMENT FRAME CLASSIFICATION UNIT 304
AC_VO QUEUE 308
AC_VI QUEUE 310
AC_BE QUEUE 312
AC_BK QUEUE 314
SCHEDULER 318
WLAN MAC 300
TO WLAN PHY

FIG. 13

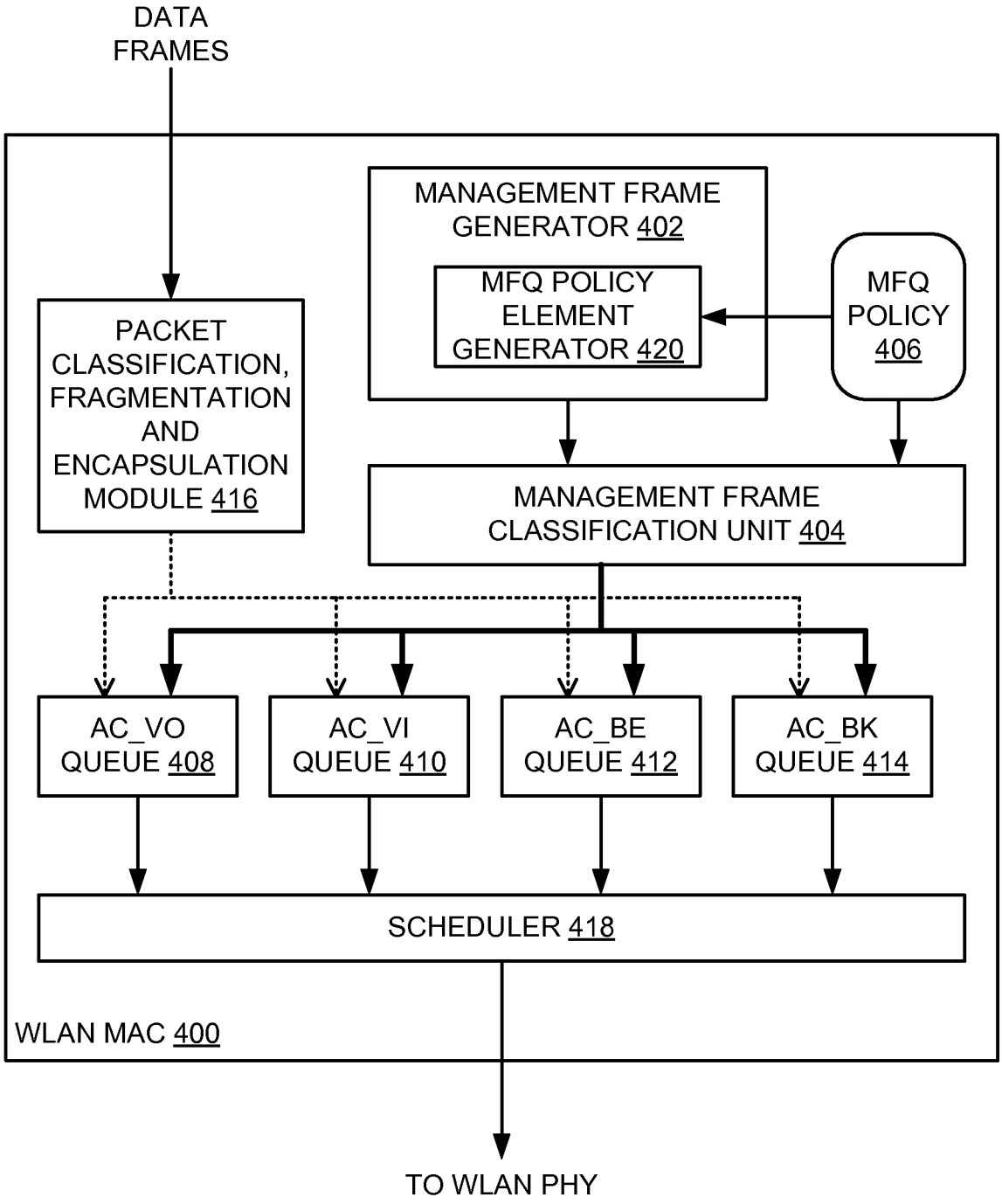

DATA FRAMES
MANAGEMENT FRAME GENERATOR 402
MFQ POLICY ELEMENT GENERATOR 420
MFQ POLICY 406
PACKET CLASSIFICATION, FRAGMENTATION AND ENCAPSULATION MODULE 416
MANAGEMENT FRAME CLASSIFICATION UNIT 404
AC_VO QUEUE 408
AC_VI QUEUE 410
AC_BE QUEUE 412
AC_BK QUEUE 414
SCHEDULER 418
WLAN MAC 400
TO WLAN PHY

FIG. 14

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1919154 A1 **[0006]**